PESTICIDE SURFACE WATER QUALITY REPORT

FEBRUARY 2005 SAMPLING EVENT

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Pesticide Monitoring Project Report
February 2005 Sampling Event

Summary

As part of the District's quarterly ambient monitoring program, unfiltered water samples from 37 sites were collected from February 22 to February 24, 2005, and analyzed for over sixty pesticides and/or degradation products. The herbicides 2,4-D, ametryn, atrazine, bromacil, hexazinone, metolachlor, norflurazon, and simazine, along with the insecticides/degradates atrazine desethyl, atrazine desisopropyl, chlorpyrifos ethyl, alpha endosulfan, beta endosulfan, and endosulfan sulfate were detected in one or more of these surface water samples. The chlorpyrifos ethyl concentration detected should not have an acute, harmful impact on fish. However, for aquatic invertebrates, this level is greater than the calculated acute and chronic toxicity for *Daphnia magna*. At this level, exposure can cause impacts to macroinvertebrate populations, but the pulsed nature of agricultural runoff releases to the canal system precludes drawing any conclusions about the effects of long-term average exposures.

The compounds and concentrations found are typical of those expected from intensive agricultural activity.

Background and Methods

The District's pesticide monitoring network includes stations designated in the Everglades Settlement Agreement, the Lake Okeechobee Operating Permit, and the non-Everglades Construction Project (non-ECP) permit. The District's canals and marshes depicted in Figure 1 are protected as Class III (fishable and swimmable) waters, while Lake Okeechobee and a segment of the Caloosahatchee River are protected as a Class I drinking water supply. Water Conservation Area 1 (WCA1) and the Everglades National Park are also designated as Outstanding Florida Waters, to which anti-degradation standards apply. Surface water and sediment are sampled quarterly and semiannually, respectively, upstream at each structure identified in the permit or agreement.

Sixty-five pesticides and degradation products were analyzed for in samples from 37 sites (Figure 1). The analytes, their respective method detection limits (MDLs), and practical quantitation limits (PQLs) are listed in Table 1. All the analytical work was performed by the Florida Department of Environmental Protection (FDEP) Central Laboratory in Tallahassee, Florida. Analytical method details can be found at the following location: http://www.dep.state.fl.us/labs/cgi-bin/sop/chemsop.asp. The reader is referred to the *Quality Assurance Evaluation* section of this report for a summary of any limitations on data validity that might influence the utility of these data.

Each pesticide's description and possible uses and sites of application described herein are taken from Hartley and Kidd (1987). The Florida Ground Water Guidance Concentrations (FGWGC) (FDEP, 1994) are listed to provide an indication at what level these pesticide residues could possibly impact human health, based on drinking water consumption or other routes of exposure (e.g., inhalation, ingestion of food residues, dermal uptake). Primary ground water standards are enforceable ground water standards, not screening tools or guidance levels. To evaluate the

potential impacts on aquatic life, due to the pulsed nature of exposure, the maximum observed concentration is compared to the Criterion Maximum Concentration published by the United States Environmental Protection Agency (USEPA) under Section 304 (a) of the Clean Water Act, if available, or the lowest EC_{50} or LC_{50} reported in the summarized literature. This summary covers surface water samples collected from February 22 to February 24, 2005.

Results

At least one pesticide was detected in surface water at 33 of the 37 sites. The concentrations of the pesticides detected at each of the sites are summarized for the surface water in Table 2. Only the chlorpyrifos ethyl concentration detected has the possibility for causing an environmental impact. All of these compounds have previously been detected in this monitoring program.

The above findings must be considered with the caveat that pesticide concentrations in surface water may vary significantly in relation to the timing and magnitude of pesticide application, rainfall events, pumping and other factors, and that this was only one sampling event. The possible long-term or chronic toxicity impacts are also reported based on the single sampling event and do not take into account previous monitoring data.

Usage and Water Quality Impacts

2,4-D: 2,4-D is a selective systemic herbicide used for the post-emergence control of annual and perennial broad leaf weeds in terrestrial (grassland, established turf, sugarcane, rice, and on non-crop areas) as well as aquatic areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that 2,4-D (1) has minimum loss from soil by surface adsorption, with a moderate loss by leaching and surface solution; (2) is slightly toxic to mammals and relatively non-toxic to fish; and (3) does not bioaccumulate significantly. The only 2,4-D concentration was detected at S191 (1.1 micrograms per liter [µg/L]) (Table 2). Using these criteria, this observed level should not have an acute impact on fish or aquatic invertebrates.

Ametryn: Ametryn is a selective terrestrial herbicide registered for use on sugarcane, bananas, pineapple, citrus, corn, and non-crop areas. Most algal effects occur at concentrations > 10 µg/L (Verschueren, 1983). Environmental fate and toxicity data in Tables 3 and 4 indicate that ametryn (1) is lost from soil relatively easily by leaching, surface adsorption, and in surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data includes a 96-hour LC_{50} of 14.1 milligrams per liter (mg/L) for goldfish (Hartley and Kidd, 1987). The ametryn surface water concentrations found in this sampling event ranged from 0.010 to 0.094 µg/L. Using these criteria, these observed surface water levels should not have an acute, detrimental impact on fish or aquatic invertebrates.

Atrazine: Atrazine is a selective systemic herbicide registered for use on pineapple, sugarcane, corn, rangelands, ornamental turf and lawn grasses, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that atrazine (1) is easily lost from soil by leaching and in surface solution, with moderate loss from surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data include a 96-hour LC_{50} of 76 mg/L for carp, 16 mg/L for perch and 4.3 mg/L for guppies (Hartley and Kidd, 1987). Also, in a flow-through bioassay, the maximum acceptable toxicant

concentration (MATC) of atrazine was 90 and 210 µg/L for bluegill and fathead minnow (Verschueren, 1983). The draft ambient aquatic life water quality criterion identify a one-hour average concentration not to exceed 1,500 µg/L more than once every three years on the average (USEPA, 2003). The atrazine surface water concentrations found in this sampling event at 30 of the 37 sampling locations, ranged from 0.011 to 1.8 µg/L. Using these criteria, these surface water levels should not have an acute or chronic detrimental impact on fish or invertebrates.

Atrazine desethyl (DEA) and atrazine desisopropyl (DIA) are biotic degradation products of atrazine. These degradation products are both persistent and mobile in water; however, DEA is more stable and the dominant initial metabolite. Since DEA and DIA are structurally and toxicologically similar to atrazine, the concentrations of total atrazine residue (atrazine + DEA + DIA) may also be a significant consideration in the surface water environment. The DEA to atrazine ratio (DAR), on a molar basis, has been suggested as an indicator of nonpoint-source pollution of groundwater (Adams and Thurman, 1991) and as a tracer of ground water discharge into rivers (Thurman et al., 1992). Goolsby et al. (1997) determined that low DAR values, median <0.1, occur in streams during runoff shortly after application of atrazine. Higher DAR values, median about 0.4, occur later in the year after considerable degradation of atrazine to DEA has occurred in the soil. The low median DAR ratio (0.2) at the locations where both atrazine and DEA were detected, suggests minimum degradation of atrazine (Table 5). However, these general guidelines were developed based on observations in Midwest watersheds in northern temperate climates with different soil and water management regimes as well as higher atrazine water concentrations. Applications to the South Florida environment should be made with caution.

Bromacil: Bromacil is a terrestrial herbicide registered for use on pineapple, citrus, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that bromacil (1) is easily lost from soil by leaching, with moderate loss from surface adsorption or surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data includes a 96-hour LC_{50} of 164 mg/L for carp (Hartley and Kidd, 1987). The highest concentration of bromacil detected in the surface water during this sampling event was at S191 (0.38 µg/L). Using these criteria, these observed levels should not have an acute or chronic detrimental impact on fish.

Chlorpyrifos ethyl: Chlorpyrifos ethyl is a non-systemic insecticide with contact, stomach, and respiratory action, for use on citrus, vegetables, rice, and household insect pests. Environmental fate and toxicity data in Tables 3 and 4 indicate that chlorpyrifos ethyl (1) is not readily lost from soil by leaching, with moderate loss from surface adsorption or surface solution; (2) is toxic to mammals and fish; and (3) bioconcentrates to a limited extent. The only concentration of chlorpyrifos ethyl found in this sampling event (0.044 µg/L at S178) should not have an acute, harmful impact on fish. However, for aquatic invertebrates, this level is greater than the calculated acute and chronic toxicity for *Daphnia magna* (Table 4). At this level, exposure can cause impacts to macroinvertebrate populations, but the pulsed nature of agricultural runoff releases to the canal system precludes drawing any conclusions about the effects of long-term average exposures.

Endosulfan: Endosulfan is a non-systemic insecticide and acaricide registered for use on many crops, including beans, tomatoes, corn, cabbage, citrus, and ornamental plants. Technical endosulfan is a mixture of the two stereoisomeric forms, the α (alpha) and the β (beta) forms. Endosulfan is highly toxic to mammals, with an acute oral LD_{50} for rats of 70 mg/Kg (Table 3). The Soil Conservation Service (SCS) rates endosulfan with an extra small potential for loss due to leaching, a large potential for loss due to surface adsorption and a moderate potential for loss in surface solution (Table 3). β endosulfan's water solubility and Henry's constant indicate volatilization may be significant in shallow waters. The bioconcentration factors indicate a low to moderate degree of accumulation in aquatic organisms (Table 3). Endosulfan (α and/or β) was detected at five locations (S176, S177, S178, S18C, and S332) in the South Miami-Dade farming area (Table 2). However, these concentrations (α plus β) do not exceed the Florida Class III surface water quality standard (FAC 62-302).

Endosulfan sulfate: Endosulfan sulfate is an oxidation metabolite of the insecticide endosulfan. The water solubility and Henry's constant indicate that endosulfan sulfate is less volatile than water and concentrations will increase as water evaporates (Table 3). Endosulfan sulfate has a relatively high degree of accumulation in aquatic organisms (Table 3). The only surface water detection occurred at S178 (0.15 μg/L). However, no FDEP surface water standard (FAC 62-302) has been promulgated for endosulfan sulfate.

Hexazinone: Hexazinone is a non-selective contact herbicide that inhibits photosynthesis. Registered uses include sugarcane, pineapple, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that hexazinone (1) is easily lost from soil by leaching, with moderate loss from surface adsorption or surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Hexazinone is practically non-toxic to freshwater invertebrates with an EC_{50} of 145 mg/L for *Daphnia magna* (USEPA, 1988). The highest surface water concentration detected in this sampling event at S4 (0.055 μg/L) should not have an acute impact on fish or aquatic invertebrates.

Metolachlor: Metolachlor is a selective herbicide used on potatoes, sugarcane, and some vegetables. Environmental fate and toxicity data in Tables 3 and 4 indicate that metolachlor (1) has a large potential for loss due to leaching and a medium potential for loss in surface solution and due to surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Metolachlor is non-toxic to birds (Lyman et al., 1990). The only surface water concentration found in this sampling event (0.13 μg/L at S178) is over two orders of magnitude below the calculated chronic toxicity level. Using these criteria, this observed level should not have a harmful impact on fish or aquatic invertebrates.

Norflurazon: Norflurazon is a selective herbicide registered for use on many crops including citrus. Environmental fate and toxicity data in Tables 3 and 4 indicate that norflurazon (1) is easily lost from soil surface solution and a moderate potential for loss due to leaching and surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. The LC_{50} for norflurazon is >200 mg/L for catfish and goldfish (Hartley and Kidd, 1987). The norflurazon surface water concentrations ranged from 0.035 to 0.50 μg/L. Even at the highest concentration, this is over several orders of magnitude below the

calculated chronic toxicity level. Using these criteria, these observed levels should not have an acute, detrimental impact on fish or aquatic invertebrates.

Simazine: Simazine is a selective systemic herbicide registered for use on many crops including sugarcane, citrus, corn, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that simazine (1) is easily lost from soil by leaching and has a moderate potential for loss due to surface adsorption and surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data include a 96-hour LC_{50} of 49 mg/L for guppies (Hartley and Kidd, 1987). Most of the aquatic biological effects occur at concentrations > 500 μg/L (Verschueren, 1983). Aquatic invertebrate LC_{50} toxicity ranges from 3.2 mg/L to 100 mg/L for simazine (USEPA, 1984). The highest surface water concentration of simazine detected at C25S99 (0.016 μg/L) was below any level of concern for fish or aquatic invertebrates.

Quality Assurance Evaluation

Replicate samples were collected at sites GORDYRD and S31. All the analytes detected in the surface water had precision ≤ 30 percent relative percent difference. No analytes were detected in the field blanks collected at S178, S3, S140, S235, and ACME1DS.

Low concentrations of representative analytes from each pesticide group/method were added to laboratory water as well as to samples submitted. For this sampling event, all the analytes for each sample adhered to the targets for precision and accuracy as outlined in the FDEP Comprehensive Quality Assurance Plan. Organic quality assurance targets are set according to historically generated data or are adapted from the USEPA with slight modifications or internal goals, based on FDEP limited data. Parameters with low or high recoveries indicate that the sample matrix interferes with these analyses and interpretation of the respective analytical results should consider this effect.

Glossary

LD_{50}: The dosage which is lethal to 50 percent of the terrestrial animals tested within a short (acute) exposure period, usually 24 to 96 hours.

LC_{50}: A concentration which is lethal to 50 percent of the aquatic animals tested within a short (acute) exposure period, usually 24 to 96 hours.

EC_{50}: A concentration necessary for 50 percent of the aquatic species tested to exhibit a toxic effect short of mortality (e.g., swimming on side or upside down, cessation of swimming) within a short (acute) exposure period, usually 24 to 96 hours.

K_{oc}: The soil/sediment partition or sorption coefficient normalized to the fraction of organic carbon in the soil. This value provides an indication of the chemical's tendency to partition between soil organic carbon and water.

Bioconcentration Factor:
The ratio of the concentration of a contaminant in an aquatic organism to the

concentration in water, after a specified period of exposure via water only. The duration of exposure should be sufficient to achieve a near steady-state condition.

Soil or water half-life:

The time required for one-half the concentration of the compound to be lost from the water or soil under the conditions of the test.

Method Detection Limits (MDLs):

The minimum concentration of an analyte that can be detected with 99 percent confidence of its presence in the sample matrix.

Practical Quantitation Limits (PQLs):

The lowest level of quantitation that can be reliably achieved within specified limit of precision and accuracy during routine laboratory operating conditions. The PQL is further verified by analyzing spike concentrations whose relative standard deviation in 20 fortified water samples is < 15 percent. In general, the PQL is 2 to 5 times larger than the MDL.

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Figure 1. South Florida Water Management District Pesticide Monitoring Network.

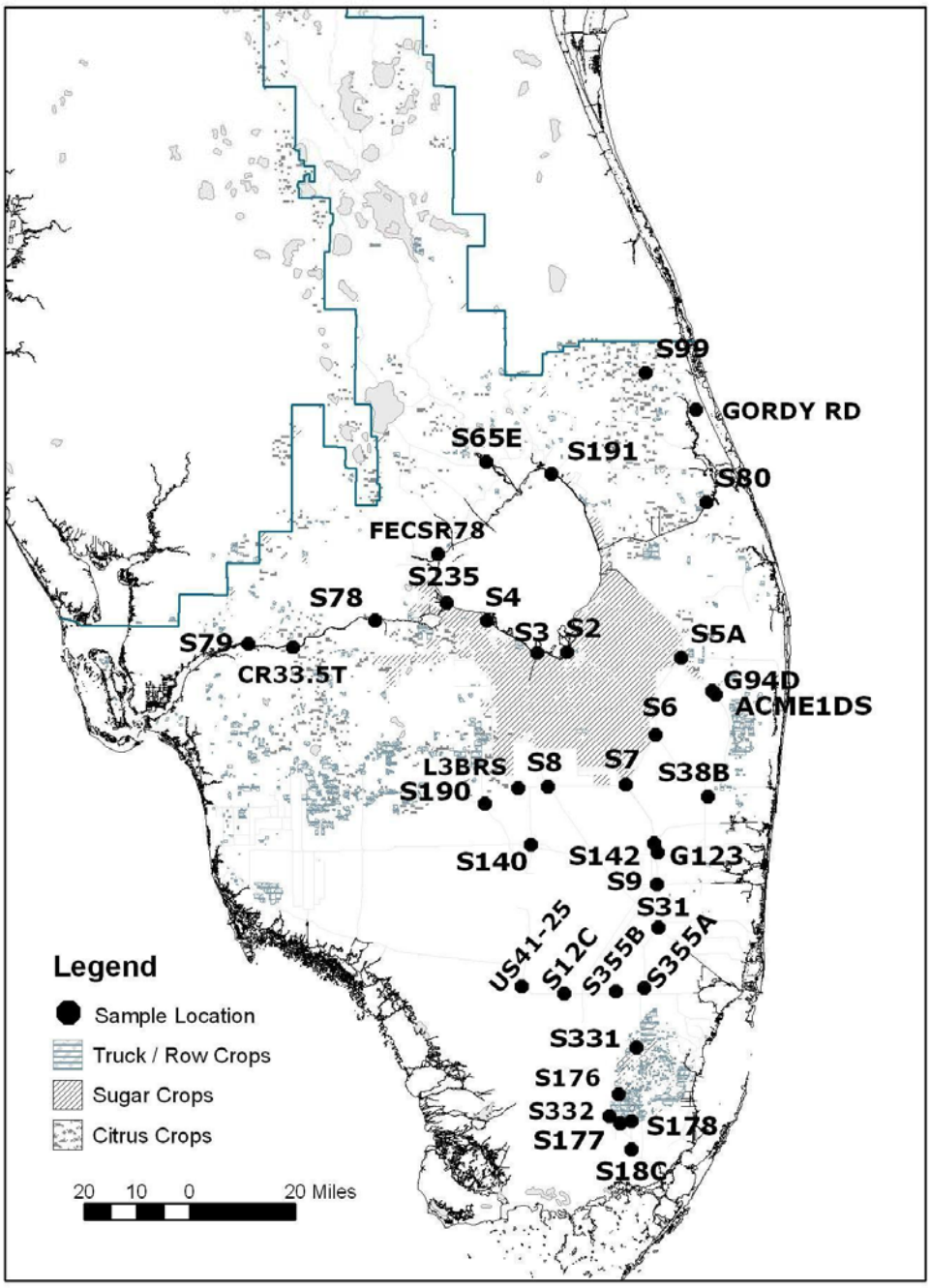

Table 1. Method detection limits (MDLs) and practical quantitation limits (PQLs) for February 2005 sampling event.

Pesticide or metabolite	Water: range of MDLs-PQLs (µg/L)	Pesticide or metabolite	Water: range of MDLs-PQLs (µg/L)
2,4-D	0.2 - 0.6	β endosulfan (beta)	0.0038 - 0.016
2,4,5-T	0.2 - 0.6	endosulfan sulfate	0.0046 - 0.039
2,4,5-TP (silvex)	0.2 - 0.6	endrin	0.0094 - 0.04
acifluorfen	0.2 - 0.6	endrin aldehyde	0.0042 - 0.018
alachlor	0.047 - 0.2	ethion	0.019 - 0.08
aldrin	0.0019 - 0.0076	ethoprop	0.019 - 0.08
ametryn	0.0094 - 0.04	fenamiphos (nemacur)	0.028 - 0.12
atrazine	0.0094 - 0.076	fonofos (dyfonate)	0.019 - 0.08
atrazine desethyl	0.0094 - 0.04	heptachlor	0.0023 - 0.015
atrazine desisopropyl	0.0094 - 0.056	heptachlor epoxide	0.0019 - 0.008
azinphos methyl (guthion)	0.019 - 0.08	hexazinone	0.019 - 0.08
α-BHC (alpha)	0.0021 - 0.0088	imidacloprid	0.2 - 0.6
β-BHC (beta)	0.0032 - 0.014	linuron	0.2 - 0.6
δ-BHC (delta)	0.0019 - 0.008	malathion	0.029 - 0.12
γ-BHC (gamma) (lindane)	0.0019 - 0.008	metalaxyl	0.047 - 0.2
bromacil	0.038 - 0.16	methoxychlor	0.0098 - 0.04
butylate	0.02 - 0.08	metolachlor	0.057 - 0.24
carbophenothion (trithion)	0.015 - 0.064	metribuzin	0.019 - 0.08
chlordane	0.019 - 0.08	mevinphos	0.075 - 0.32
chlorothalonil	0.015 - 0.064	mirex	0.011 - 0.048
chlorpyrifos ethyl	0.02 - 0.08	naled	0.075 - 0.32
chlorpyrifos methyl	0.0094 - 0.04	norflurazon	0.019 - 0.08
cypermethrin	0.019 - 0.08	parathion ethyl	0.019 - 0.08
DDD-P,P'	0.0045 - 0.019	parathion methyl	0.019 - 0.08
DDE-P,P'	0.0038 - 0.018	PCB	0.019 - 0.08
DDT-P,P'	0.0057 - 0.024	permethrin	0.015 - 0.064
demeton	0.11 - 0.48	phorate	0.028 - 0.12
diazinon	0.019 - 0.08	prometon	0.019 - 0.08
dicofol (kelthane)	0.042 - 0.18	prometryn	0.019 - 0.08
dieldrin	0.0019 - 0.008	simazine	0.0094 - 0.04
disulfoton	0.019 - 0.08	toxaphene	0.095 - 0.4
diuron	0.2 - 0.6	trifluralin	0.0075 - 0.032
α endosulfan (alpha)	0.0038 - 0.016		

N/A - not analyzed

Table 2. Summary of pesticide residues (µg/L) above the method detection limit found in surface water samples collected by SFWMD in February 2005.

Date	Site	Flow	2,4-D	ametryn	atrazine	atrazine desethyl	atrazine desisopropyl	bromacil	chlorpyrifos ethyl	alpha endosulfan	beta endosulfan	endosulfan sulfate	hexazinone	metolachlor	norflurazon	simazine	Number of compounds detected at site
2/22/2005	S18C	N	-	-	-	-	-	-	-	0.0059 I	-	-	-	-	-	-	1
	S178	N	-	-	0.038 I	-	-	-	0.044 I	0.026	0.0080 I	0.15	-	0.13 I	-	-	6
	S177	Y	-	-	0.015 I	-	-	-	-	0.014 I	0.0038 I	-	-	-	-	-	3
	S332	N	-	-	0.018 I	-	-	-	-	0.0060 I	-	-	-	-	-	-	2
	S176	Y	-	-	0.013 I	-	-	-	-	0.0068 I	-	-	-	-	-	-	2
	S331	N	-	-	0.015 I	-	-	-	-	-	-	-	-	-	-	-	1
	S355B	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	S355A	N	-	-	0.011 I	-	-	-	-	-	-	-	-	-	-	-	1
	S12C	N	-	-	0.015 I	-	-	-	-	-	-	-	-	-	-	-	1
	US41-25	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	C25S99	N	-	-	-	-	-	0.069 I	-	-	-	-	0.042 I	-	0.50	0.016 I	4
	GORDYRD	Y	-	-	-	-	-	-	-	-	-	-	-	-	0.38 *	0.010 I *	2
	S80	N	-	-	0.11	0.019 I	-	-	-	-	-	-	0.031 I	-	0.058 I	-	4
	S2	N	-	-	0.13	0.020 I	-	-	-	-	-	-	0.032 I	-	-	-	3
	S3	R	-	-	0.18	0.021 I	-	-	-	-	-	-	0.034 I	-	-	-	3
	S4	N	-	0.094	1.8	0.053	0.013 I	-	-	-	-	-	0.055 I	-	-	0.015 I	6
2/23/2005	S31	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	S9	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	G123	N	-	0.012 I	0.054	-	-	-	-	-	-	-	-	-	-	-	2
	S142	N	-	0.014 I	0.058	-	-	-	-	-	-	-	-	-	-	-	2
	S140	N	-	-	0.03 I	-	-	-	-	-	-	-	-	-	0.072 I	0.012 I	3
	S190	N	-	-	0.027 I	-	-	-	-	-	-	-	-	-	0.035 I	-	2
	L3BRS	Y	-	-	0.07	-	-	-	-	-	-	-	-	-	-	-	1
	S8	N	-	-	0.083	-	-	-	-	-	-	-	-	-	-	-	1
	S7	N	-	0.010 I	0.26	0.025 I	-	-	-	-	-	-	-	-	-	-	3
	S191	N	1.1	-	0.014 I	-	-	0.38	-	-	-	-	-	-	-	-	3
	S79	Y	-	-	0.11	0.018 I	-	-	-	-	-	-	0.038 I	-	0.052 I	-	4
	CR33.5T	R	-	-	0.1	0.017 I	-	-	-	-	-	-	0.030 I	-	0.075 I	-	4
	S78	N	-	-	0.11	0.017 I	-	-	-	-	-	-	0.039 I	-	-	-	3
	S235	R	-	-	0.1	0.018 I	-	-	-	-	-	-	0.046 I	-	-	-	3
	FECSR78	N	-	-	0.034 I	-	-	-	-	-	-	-	-	-	-	-	1
	S65E	Y	-	-	0.059	-	-	-	-	-	-	-	-	-	-	-	1
2/24/2005	S38B	N	-	0.016 I	1.1	0.10	-	-	-	-	-	-	-	-	-	-	3
	S6	N	-	0.055	0.61	0.020 I	-	-	-	-	-	-	-	-	-	-	3
	S5A	N	-	-	0.16	0.025 I	-	-	-	-	-	-	0.030 I	-	-	-	3
	ACME1DS	N	-	0.028 I	0.13	0.014 I	-	-	-	-	-	-	-	-	-	-	3
	G94D	N	-	0.025 I	0.12	-	-	-	-	-	-	-	-	-	-	-	2
Total number of compound detections			1	8	30	13	1	2	1	5	2	1	10	1	7	4	86

N - no Y - yes R - reverse; - denotes that the result is below the MDL; * results are the average of replicate samples
I - value reported is less than the practical quantitative limit, and greater than or equal to the method detection limit.

Table 3. Selected properties of pesticides found in February 2005 sampling event.

Common Name	Surface Water Standards FAC 62-302 (µg/L)	Ground Water Guidance Conc. (µg/L)	LD_{50} acute rats oral (mg/kg) (1)	EPA Carcinogenic Potential	Water Solubility (mg/L) (2, 3)	Koc (mL/g) (2, 3)	Soil Half-life (days) (2, 3)	Soil Conservation Service (SCS) Rating (2)			Volatility frrom Water	Bioconcentration Factor (BCF)
								LE	SA	SS		
2,4-D (acid)	(100)	70**	375	D	890	20	10	M	S	M	I	13
ametryn	-	63	1110	D	185	300	60	M	M	M	I	33
atrazine	-	3**	3080	C	33	100	60	L	M	L	I	86
bromacil	-	90	5200	C	700	32	60	L	M	M	I	15
chlorpyrifos ethyl	-	21	135 - 163	D	2	6070	30	S	M	M	-	418
endosulfan alpha	0.056	0.35	70	-	0.53	12400	50	XS	L	M	S	884
endosulfan beta	-	0.35	70	-	0.28	-	-	-	-	-	S	1267
endosulfan sulfate	-	0.3	-	-	0.117	-	-	-	-	-	I	2073
hexazinone	-	231	1690	D	33000	54	90	L	M	M	I	2
metolachlor	-	1050	2780	C	530	200	90	L	M	M	I	18
norflurazon	-	280	9400	C	28	700	90	M	M	L	I	94
simazine	-	4**	>5000	C	6.2	130	60	L	M	M	I	221

SCS Ratings are pesticide loss due to leaching (LE), surface adsorption (SA) or surface solution (SS) and grouped as large(L), medium (M), small (S) or extra small (XS)
Volatility from water: R = rapid, I = insignificant, S = significant
Bioconcentration Factor (BCF) calculated as $BCF = 10^{(2.791 - 0.564 \log WS)}$ (4)
B2: probable human carcinogen; C: possible human carcinogen; D: not classified; E: evidence of non-carcinogen for humans (5)
FDEP surface water standards (4/95) for Class III waters except Class I in ( )
Note: endosulfan usually considered the sum of alpha and beta isomers
** primary standard

(1) Hartley, D. and H. Kidd. (Eds.) (1987).
(2) Goss, D. and R. Wauchope. (Eds.) (1992).
(3) Montgomery, J.H. (1993).
(4) Lyman,W.J., W.F. Reehl, and D.H. Rosenblatt. (1990).
(5) U.S. Environmental Protection Agency (1996).

Table 4. Toxicity of pesticides found in the February 2005 sampling event to freshwater aquatic invertebrates and fishes (µg/L).

Common Name	48-hr EC_{50} Water flea *Daphnia magna*		acute toxicity (*)	chronic toxicity (*)	96-hr LC_{50} Fathead Minnow (#) *Pimephales promelas*		acute toxicity	chronic toxicity	96-hr LC_{50} Bluegill *Lepomis macrochirus*		acute toxicity	chronic toxicity	96-hr LC_{50} Largemouth Bass *Micropterus salmoides*		acute toxicity	chronic toxicity	96-hr LC_{50} Rainbow Trout (#) *Oncorhynchus mykiss*		acute toxicity	chronic toxicity	96-hr LC_{50} Channel Catfish *Ictalurus punctatus*		acute toxicity	chronic toxicity
2,4-D	25,000	(7)	8333	1,250	133,000	(7)	44,333	6,650	180,000	(8)	60,000	9,000	-		-	-	100,000	(4)	33,333	5,000	-		-	-
	-		-	-	-		-	-	900 (48 hr.)	(6)	-	-	-		-	-	110,000	(7)	36,667	5,500	-		-	-
ametryn	28,000	(7)	9333	1,400	-		-	-	4,100	(4)	1,367	205	-		-	-	8,800	(4)	2,933	440	-		-	-
atrazine	6900	(7)	2300	345	15,000	(7)	5,000	750	16,000	(4)	5,333	800	-		-	-	8,800	(4)	2,933	440	7,600	(4)	2,533	380
bromacil	-		-	-	-		-	-	127,000	(5)	42,333	6,350			-	-	36,000	(5)	12,000	1,800			-	-
chlorpyrifos	1.7	(7)	0.57	0.085	203	(7)	68	10	2.6	(4)	0.87	0.13	-		-	-	11	(4)	3.7	0.55	280	(7)	93	14
ethyl	0.1	(7)	0.03	0.005	-		-	-	5.8	(7)	1.93	0.29	-		-	-	-		-	-	-		-	-
endosulfan	166	(7)	55	8	1	(1)	0.3	0.05	1	(1)	0.33	0.05	-		-	-	1	(1)	0.33	0.050	1	(1)	0.3	0.05
	-		-	-	-		-	-	2	(3)	0.67	0.10	-		-	-	3	(2)	1	0.15	1.5	(7)	0.5	0.08
	-		-	-	-		-	-	-		-	-	-		-	-	1	(3)	0.33	0.050	-		-	-
	-		-	-	-		-	-	-		-	-	-		-	-	0.3	(5)	0.10	0.015	-		-	-
hexazinone	151,600	(7)	50,533	7,580	274,000	(4)	91,333	13,700	100,000	(7)	33,333	5,000	-		-	-	180,000	(7)	60,000	9,000	-		-	-
metolachlor	23,500	(7)	7,833	1,175	-		-	-	15,000	(4)	5,000	750	-		-	-	2,000	(4)	667	100	4,900	(5)	1,633	245
norflurazon	15,000	(7)	5,000	750	-		-	-	16,300	(7)	5,433	815	-		-	-	8,100	(7)	2,700	405	>200,000	(4)	>67,000	>10,000
simazine	1,100	(7)	367	55	100,000	(7)	33,333	5,000	90,000	(4)	30,000	4,500	-		-	-	100,000	(7)	33,333	5,000	-		-	-

(*) Florida Administrative Code (FAC) 62-302.200, for compounds not specifically listed, acute and chronic toxicity standards are calculated as one-third and one-twentieth, respectively, of the amount lethal to 50% of the test organisms in 96 hours, where the 96 hour LC50 is the lowest value which has been determined for a species significant to the indigenous aquatic community.
(#) Species is not indigenous. Information is given for comparison purposes only.

(1) Johnson, W. W. and M.T. Finley (1980).
(2) U.S. Environmental Protection Agency (1977).
(3) Schneider, B.A. (Ed.) (1979).
(4) Hartley, D. and H. Kidd. (Eds.) (1987).
(5) Montgomery, J.H. (1993).
(6) Verschueren, K. (1983).
(7) U.S. Environmental Protection Agency (1991).
(8) Mayer, F.L., and M.R. Ellersieck (1986).

Table 5. Atrazine desethyl/atrazine ratio (DAR) data for February 2005 sampling event.

Date	Site	Flow*	atrazine ug/L	moles/L	atrazine desethyl ug/L	moles/L	DAR
2/22/2005	S80	N	0.11	5.10E-10	0.019	1.01E-10	0.2
	S2	N	0.13	6.03E-10	0.020	1.07E-10	0.2
	S3	R	0.18	8.35E-10	0.021	1.12E-10	0.1
	S4	N	1.8	8.35E-09	0.053	2.82E-10	0.0
2/23/2005	S7	N	0.26	1.21E-09	0.025	1.33E-10	0.1
	S79	Y	0.11	5.10E-10	0.018	9.59E-11	0.2
	CR33.5T	R	0.1	4.64E-10	0.017	9.06E-11	0.2
	S78	N	0.11	5.10E-10	0.017	9.06E-11	0.2
	S235	R	0.1	4.64E-10	0.018	9.59E-11	0.2
2/24/2005	S38B	N	1.1	5.10E-09	0.10	5.33E-10	0.1
	S6	N	0.61	2.83E-09	0.020	1.07E-10	0.0
	S5A	N	0.16	7.42E-10	0.025	1.33E-10	0.2
	ACME1DS	N	0.13	6.03E-10	0.014	7.46E-11	0.1

* N - no; Y - yes; R - reverse

DAR	All sites	Flow only sites	No flow sites
average	0.1	0.2	0.1
median	0.2	0.2	0.1
minimum	0.0	0.2	0.0
maximum	0.2	0.2	0.2